APPENDIX I

GREATER CURLEW VALLEY AREA
SAGE GROUSE POPULATION TRENDS
AND VEGETATIVE TRENDS

POPULATION TRENDS

Introduction

Diary entries from early settlers indicate that sage grouse were numerous in southeastern Idaho and comprised an important part of their diet (Meeker 1927 and Townsend 1834). Greater Curlew Valley Area (GCVA) residents have reported that sage grouse were numerous in the 1920's and 1930's (F. Hill and J. Spillett, comment letters). The 1966 draft Wildlife Management Plan for the Curlew says "Old timers tell of the excellent sagehen hunting in Buist and Curlew Valleys. It was not uncommon to see sage grouse numbering in the hundreds". It is not clear how these qualitative assessments compare to today's numbers.

Declines have been reported range-wide for sage grouse and they have been extirpated in 5 states and 1 province on the edge of their original distribution (Braun 1998). Concerns were first raised in the early part of the 20th century, when overgrazing, burning, cultivation and excessive harvest in the late 1800's and early 1900's appeared to be a problem. This was also followed by a drought period in the 1930's. As a result, hunting seasons were reduced or closed. Numbers appeared to increase in the 1940's and 1950's, with seven states opening hunting seasons. This was followed by declines in the 1960's and 1970's (in Connelly and Braun 1997). This corresponds to a period in the mid to late 1960's when many hunting seasons were liberalized and reopened (Braun 1998).

Population trend methods

There are three primary recommended sources of information on sage grouse populations; lek counts, recruitment of young in the fall population, and sage grouse hunter participation measured at check stations. Each of these data sources has its limitations but will be discussed. Autenrieth (1981) also recommend brood counts; either through established brood routes or random brood counts. Both methods have problems and have not been used to any great extent over either the GCVA or CNG. Connelly *et al* (2000) state that brood counts are labor intensive and usually result in an inadequate sample size. They recommended using wing surveys to estimate sage grouse nesting success and juvenile to adult hen ratios.

Trends will be considered at two different scales; the Greater Curlew Valley Area (GCVA) and the Curlew National Grasslands (CNG). The GCVA is considered a breeding population (Connelly *et al* define a breeding population as separated from other areas by >20 km). This analysis area was used by both Gardner (1997) and Apa (1998). The CNG comprises only 9% of the GCVA, but will be considered as well.

Lek Count Surveys in the GCVA

Connelly *et al* (2000) addressed lek count data. "Depending on number of counts each spring and weather conditions when the counts were made, lek counts may not provide an accurate assessment of sage grouse population levels and data should be viewed with caution. However, lek counts provide the best index to breeding population levels and many long-term data sets are available for trend analysis." Lek observations may be a useful indicator of long-term population trends. However, the high variance in these data indicates that other forms of information should be collected as well. It would be risky to base management recommendations soley on lek counts (Western States Sage Grouse Comm, 1982).

Count protocols were not well established until scientific studies were done (Jenni and Hartzler 1978). There are many variables that may affect male sage grouse attendance on leks (predators, attendance by females, ambient weather conditions, interlek movements, disturbances around lek, and seasonal and daily timing of surveys). To deal with these variables, IDFG established a survey protocol in 1988 to be used for lek surveys. This protocol says three counts should be conducted per lek between 20 March and 5 May, preferable early, mid and late April. These counts should be conducted from ½ hour before sunrise to 1 ½ hour after sunrise. The Forest Service is following the time and seasonal criteria, but is not making three counts per lek.

Formal record keeping of sage grouse leks began in 1967. Both the Forest Service and IDFG have kept records since that time; however prior to 1988 surveys did not use the protocol. Most of the Forest Service data is still not collected according to the protocol (dates and timing of surveys is OK, but three counts are generally not done). In the earliest years there were only a couple of known leks and survey intensity has varied over time. The number of leks, and the specific leks surveyed have varied, making it difficult to look at trends over time. Leks have been shown to move over time, and the FS data has generally been recorded by lek name; it is difficult to make direct correlations between the two sets (FS and IDFG) of data.

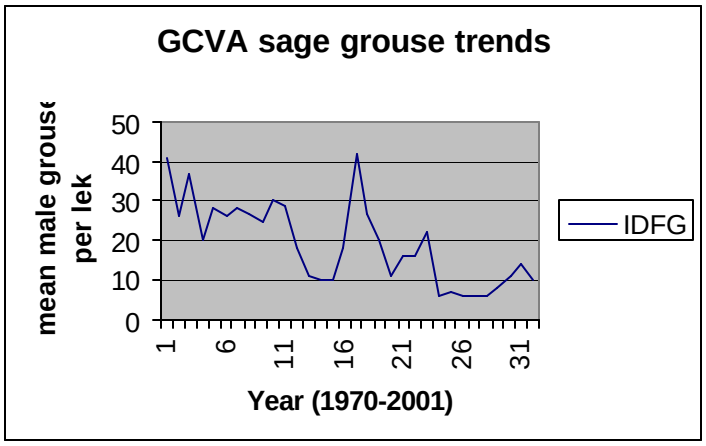
It has been suggested by K. Timothy that leks on the CNG generally become established and stay in existence approximately 5 years, and then decline or are abandoned. However, when looking at the data, this is not obvious. There are so many years with missing data that no obvious trends can be seen (see Appendix B). The problem may be that the Forest Service lek data is recorded by lek name, rather than a location. While a lek may have moved to a location in the same area, it kept the same name.

As a result, both sets of data will be reviewed independently. The IDFG data will be used to look at trends over the GCVA, as they have data over the larger area (Appendix A). FS data will be used to look at trends on the CNG (Appendix B).

Long-term Sage Grouse Population Trends on the GCVA (IDFG data)

The most commonly used measure of sage grouse populations is to calculate **the mean number of male sage grouse per lek**. The assumption is that as total numbers go up or down, the number of males on the lek will go up or down accordingly. The graph below shows the trends in mean

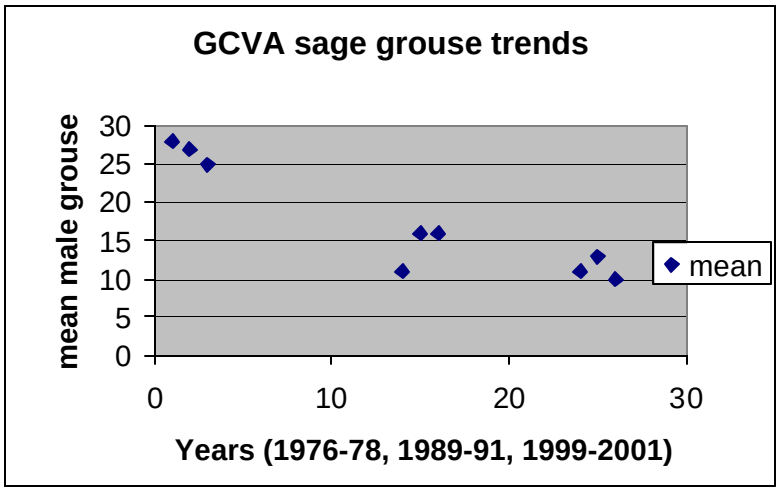
number of male sage grouse per lek, based on IDFG data (Appendix A). **These data indicate a cyclic but generally declining trend over the GCVA for the last 30 years.**



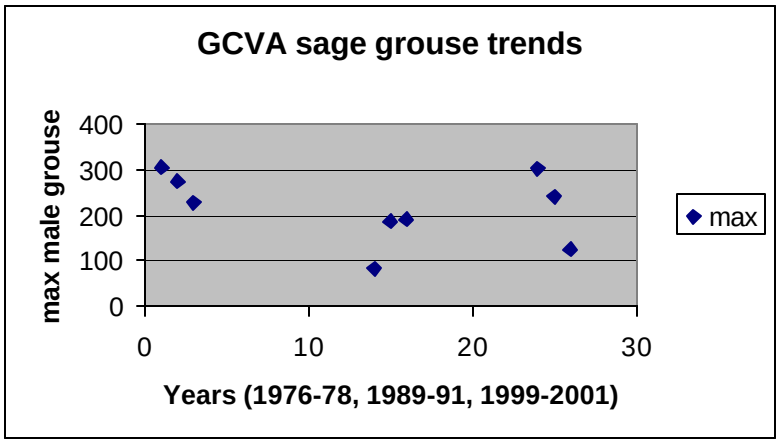
Gardner (1997) also looked at average males per lek over the GCVA. However, in his table, he used only the main leks and added satellite groups to the main lek (not consistent with IDFG records). Another problem was that he included inactive leks to calculate the average. He states that there is an average of <3 males/lek, but the above analysis shows an average of 9 (FS data) or 6 (IDFG data) males/lek in 1997. The decision was made to not use Gardners analysis, because of the problems associated with it.

There is debate over whether the mean number of male sage grouse per lek actually reflects changes on the GCVA. In the earlier years, there were fewer leks counted but they had more males per lek. **In more recent years, there have been more leks found, but they generally have a lower number of males per lek** (see Appendix H

To try to get around the problem of varied survey efforts over time, we looked at three periods when we thought the data, and survey effort may be comparable. D. Meints (IDFG) selected three consecutive years within 3 periods about one decade apart. These years were chosen because of the similarly large numbers of leks sampled in each of these years. The periods selected were 1976-1978, 1989-1991 and 1999-2001.



Based on the mean number of male sage grouse per lek, these data suggest a large decline during the first period (1978 to 1989) and a smaller decline in the second period (1991 to 1999) over the GCVA**.**



When looking at the maximum number of males observed on all the leks, the numbers increase in the last period. However, survey intensities are not directly comparable as shown below and no clear trend can be drawn from this data.

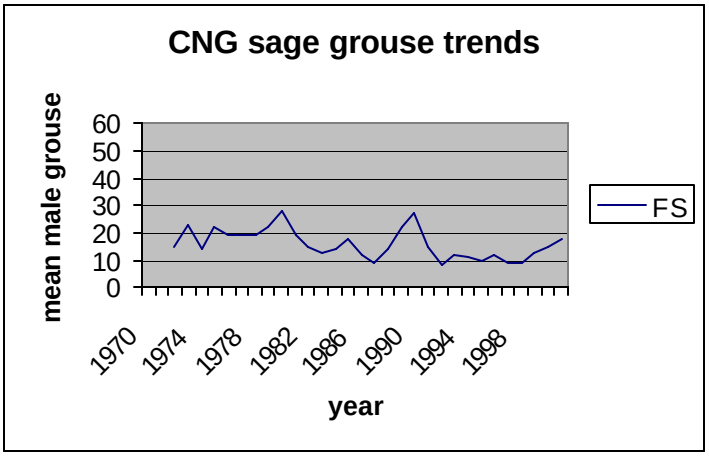
Survey period	Ave. total males	Ave. no. leks surveyed	Ave. no. males per lek
1976-78	268	10	27
1989-91	154	11	14
1999-2001	223	19	11

Long-term trends on the CNG (FS data)

In the 1967 CNG Wildlife Inventory and Habitat Study by Frank Gunnell, it was reported that sage grouse numbers seem to be declining and populations are low. He also reported that there was only one known booming ground but questions if there were more. Autenrieth (1981) said

that there were 8 trend transects censused since 1976, within the boundaries of the CNG, with some increasing and some decreasing. He stated that "it appears sage grouse are re-establishing in this area after the years of sagebrush removal ended. Interlek movements appear to be more frequent than usual, possibly indicating lek traditions are yet to be re-established. One of the most important needs in this area is providing forbs critical to brood success."

FS data (Appendix B) was used to plot sage grouse population trends on the CNG. **Based on mean male sage grouse per lek, it appears that the population has fluctuated widely, with a generally declining trend over the 30-year period.**

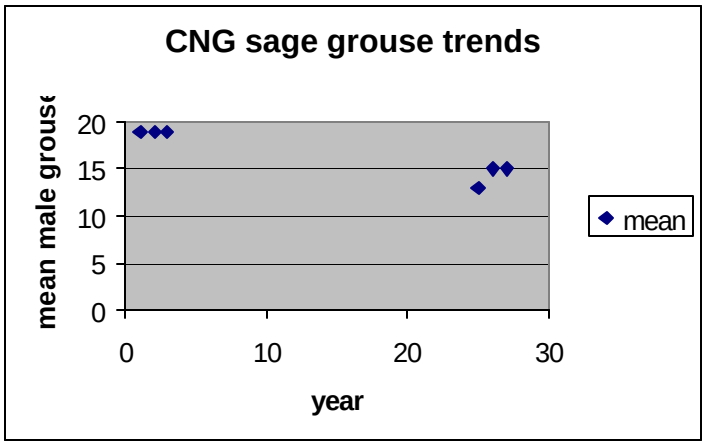


There is debate over whether the mean number of male sage grouse per lek actually reflects changes on the CNG. In the earlier years, there were fewer leks counted but they had more males per lek. **In more recent years, there have been more leks found, but they generally have a lower number of males per lek** (see Appendix H). **The larger number of leks currently known may be a result of increased sagebrush canopy cover over the Curlew; as suitable habitat increases, leks are more widely distributed** (see sagebrush habitat section). This agrees with Autenrieth's suggestion that lek traditions were being re-established (1981).

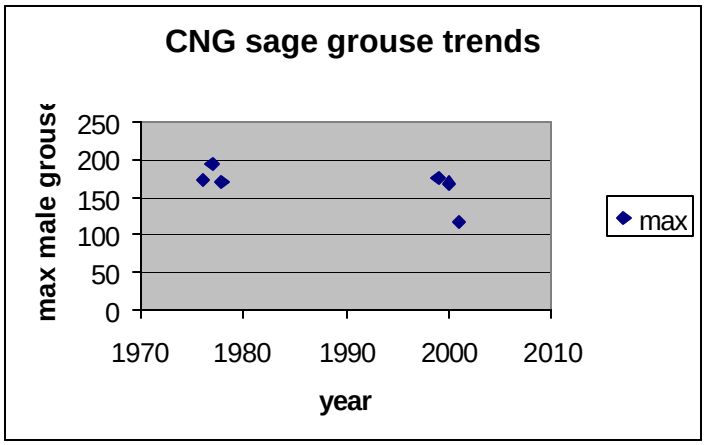
Total number of male sage grouse comparisons are difficult because of yearly variations in survey intensity. To try to get around the problem of varied survey efforts over time, three periods were reviewed. It was initially thought that the data, and survey effort may be comparable. The first time period, 1967-69 was initially believed to be a good starting point because efforts had made to aerial survey for leks. A report from June 1968 documents that aerial surveys were done on May 1 and May 3, over the west and northwest part of the area and no new leks were found. However, the whole CNG was not surveyed, and the survey period was past the peak period identified by Apa (1998) as being from 3/6 to 3/20. In addition, Connelly (personal communication) states that the average success of finding leks through aerial surveys is about 70%. Additional field surveys were done, but these were outside of the mating season. It is felt that the data for this period does not reflect the picture over the whole CNG.

The second time period in the mid- to late 1970's, survey efforts intensified. State biologists were making concerted efforts to survey sage grouse to establish hunting seasons (J. Connelly

personal communication). Survey efforts increased again in 1999 to present, due to concerns about population declines. These two periods were used to evaluate the trends displayed below.



Based on the mean number of male sage grouse per lek, these data suggest a decline in sage grouse numbers on the CNG between the two periods (1976-79 to 1999-2001).



When looking at the maximum number of males observed on all the leks, the numbers in the last period still decrease, even though more leks were surveyed. However, survey intensities are not directly comparable as shown below and no clear trend can be drawn from this data.

Survey period	Ave. total males	Ave. no. leks surveyed	Ave. no. males per lek
1976-78	180	9	19
1999-2001	154	11	14

It has been suggested by K. Timothy (25 June 2001) that there has been a large (709%) increase in sage grouse on the CNG from 1967 to 1999. This is based on the assumption that the surveys in 1967 did find the majority of sage grouse on the CNG. However, as pointed out above, data from this period may not be as complete as thought.

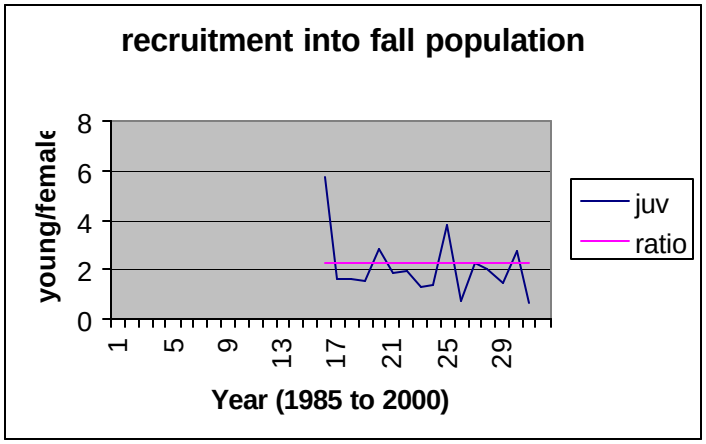
Short-term Sage Grouse Population Trends

Sage grouse populations have been shown to be cyclic (Rich 1985), which is reflected in both the IDFG and FS data. Because, of this cyclic nature, it is hard to draw conclusions on just a few years of data. In early 2001, the Curlew Working Group reached a general concensus that sage grouse populations had stabilized over the previous three years (D. Meints, IDFG, personal communication). However, wing data from the previous fall's hunting season (2000) wasn't available at that time. That data, which indicated a low percentage of juveniles in the harvest, was reinforced by the spring 2001 lek counts that showed another decline in numbers.

In 1996, IDFG established a couple of trend transects in the GCVA. These transects were established to be better able to track population trends in the future. Currently, there are too few years of data to draw any conclusions (see Appendix C)

Population trends based on recruitment of young into the fall population

Research studies of sage grouse population dynamics indicate that the number of young sage grouse surviving to the fall for each adult hen is a good indication of population trend. Available data suggests that a ratio of >2.25 juveniles/hen in the fall should result in stable to increasing sage grouse populations (Connelly *et al*, 2000).



The sage grouse production data is based on wing data collected since 1985. For the Curlew unit of the Southeast Region this data indicates that recruitment of young met or exceeded the minimum level needed in only 5 out of 16 years. **This suggests that there is a problem with recruitment of young into the population.** However, there have been very small sample sizes since 1996, when hunting seasons changed and data from this period to present are less reliable.

Population trends based on hunter participation and success

Data is very limited. Population demographics, weather and changes in hunting seasons all affect hunter numbers. No check stations have been run for at least 10 years. Because of low numbers of hunters and wing samples, no conclusions can be drawn from this limited data. Also, many survey results can be skewed by a few inaccurate reports. One recent report estimates 12,000

sage grouse harvested, while there are not that many grouse in southeast Idaho (J. Connelly, IDFG, pers. comm.).

FACTORS AFFECTING SAGE GROUSE AND RELATION TO GCVA AND CNG

Introduction

Quigley *et al* (1996) define high ecological integrity as "a mosaic of plant and animal communities consisting of well-connected, high-quality habitats that support a diverse assemblage of native and desired non-native species, the full expression of potential life histories and taxonomic lineages, and the taxonomic and genetic diversity necessary for long-term persistence and adaptation in a variable environment." Measures of rangeland integrity include such elements as: (1) grazing influences on vegetation patterns and composition; (2) distruptions to the hydrologic regimes; (3) expansion of exotic species; (4) changes in fire severity and frequency; (5) increases in bare soils; and (6) expansion of woodlands into herblands and shrublands. Based on these criteria**, the CNG would rate low in ecological integrity** (Quigley *et al*, 1996).

Sage grouse on the GCVA are non-migratory, not making long-distance (>10 km) movements between seasonal ranges. They have also have high fidelity to seasonal ranges. Autenrieth (1981) suggested that the most critical periods in Idaho usually relate to weather during hatching and availability of forbs and insects following hatching.

Apa (1998) concluded that upper elevation sites in the GCVA on BLM provided the best sage grouse nesting habitat. The lower elevation CNG has been managed for forage production and is dominated by non-native understory species. This has lowered the quality of the habitat for nesting by sage grouse. Sagebrush canopy cover has increased on the CNG in the last 50 years.

Factors

Multiple factors may be contributing to the decline in sage grouse populations across the west (Braun 1998, Miller and Eddleman 2001, Connelly *et al* 2000, IDFG 1997). Sage grouse population declines have been attributed to many factors. Braun (1998) categorizes these as permanent habitat loss (agriculture, ranches/farms/towns, reservoirs and roads/highways); permanent habitat fragmentation (fences, powerlines and previous factors); short-term habitat degradation (treatments such as burning and grazing that affect understory and overstory structure); and natural changes (drought, predation, and hunting).

Connelly *et al.* (2000) summarized results from studies in southern Idaho. They looked at cause of death for 117 radio-marked sage grouse that died through the study: 62% died due to predation, 32% were hunted, 3% died as a result of vehicle collisions, <1% collided with powerlines and 2% were other. These numbers are based on the fate of the bird thru the survey period, they are not an annual measure. They concluded that female sage grouse were more likely to die from hunting than were male grouse (42% for females compared to 15% for males). They also concluded that predation had little impact on sage grouse population on a yearly basis.

HABITAT LOSS

AGRICULTURE/RANCHES/FARMS/TOWNS

There are 75,000 acres within the proclaimed boundary of the CNG. Of this, 47,600 acres (63%) are managed by USFS. Only 12,000 acres of the federal lands (25%) have never been farmed, plowed or chained. Assuming that this proportion is true over the whole CNG (due to soils, rocks, steep slopes etc), there are approximately 18,750 acres that have never been farmed, plowed or chained. **At least 75% of the CNG has been plowed and farmed sometime in the past.** Much of the area has been seeded to non-native grass and forb species, reducing understory diversity.

Of the 27,400 acres of private land now within the proclaimed boundary of the CNG, 20% is in CRP, 38% is in farmland and 42% is in pasture (FSA and NRCS Records 2000). It is assumed that most of this private land is not, and will not be sage grouse nesting or winter habitat over the short-term (CRP may become usable over the long-term if the program continues) but it may be used during the brood-rearing season when hens and chicks are looking for green succulent vegetation.

RESERVOIRS/RECREATION DEVELOPMENTS

Existing facilities are Stone Reservoir (133 acres of reservoir, around 200 acres impacted), Curlew Campground (10 acres), Twin Springs Campground (10 acres) and Sweeten Pond (20 acres). **These developments permanently reduce habitat by around 240 acres.**

ROADS/HIGHWAYS

There are 25.8 miles of paved roads through the Proclaimed boundary of the CNG. In addition, there are another 162 miles of road**. The combination of 188 miles or roads results in the permanent loss of approximately 240 acres of habitat** (based on 12' average width).

The high-standard roads increase chances for vehicle collisions. When Connelly *et al* (2000) determined cause of death for radio-marked sage grouse in southern Idaho, they found about 3% that were attributed to vehicle collisions.

Studies in Yellowstone National Park found that vehicle speeds of 45mph or less reduced the frequency of road-killed wildlife (Gunther *et al*, 1998). **The 25.8 miles of paved highways through the Proclaimed boundary of the CNG increase the potential for sage grouse to be killed by vehicles (14% of total road miles).**

HABITAT FRAGMENTATION

FENCES

The question about the effects of fencing and increased predator (raptor) perches was raised on a 1965 field trip (P. Plummer, 1965). At that time, wooden posts were used and it was thought that it might have been better to use steel posts.

Fence posts have been identified as a risk factor to sage grouse. Wooden posts provide perch sites for raptors, and there is a risk of injury when sage grouse fly into fences (Connelly *et al*, 2000). Generally, fences with more than 3 wires and woven wire fences are of concern (Braun 1998). Braun also identifies paths along fences as movement corridors for potential predators.

Approximately 300 miles of fence currently exist on the Grasslands, including perimeter fences. These fences are four-strand barbed wire with a pattern of five steel posts to one wooden post. It is not known what affect the current level of fencing is having on sage grouse on the Grassland. One report has been documented of sharp-tailed grouse flying into fences (D. Meints, IDFG Biologist, pers. com.).

POWERLINES

About 18 miles of powerlines currently exist on the federal portion of the CNG. There are additional miles on private lands within the proclaimed boundary, but as mentioned above, most of this is not considered suitable habitat. However, where these are adjacent to suitable habitat, they may be providing perches for predators and may also be obstacles for flying sage grouse and result in collisions. Connelly *et al* (2000) found 1 out of 117 radio-marked sage grouse that was attributed to a collision with a powerline.

TREE ROWS

Currently there are about 21 miles of tree rows on the Grassland. There are additional tree rows and windbreaks planted on private lands within the proclaimed boundary. Much of this is not considered suitable habitat. However, where the tree rows are adjacent to suitable habitat, they may be providing perches for predators.

The selected alternative does not include planting of new tree rows.

SHORT-TERM HABITAT DEGRADATION

SAGEBRUSH TREATMENTS

As documented in the Sagebrush Vegetative Trends Process Paper at the end of this Appendix, it appears that the trend over the GCVA has been to more open sagebrush canopy cover since pre-settlement. However, on the CNG the trend has been to increased sagebrush canopy cover compared to pre-settlement and historic conditions. In addition to improved overstory conditions, it is believed that understory grass and forb conditions have improved since heavy livestock

grazing in the 1920's and 1930's and since farming ceased (referenced in F. Hills and Perry Plummers letters). However, understory diversity is greatly reduced over natural conditions, due to seedings in the past.

By the end of the 1930's, 75% of the CNG had been farmed. About 25% had not been farmed, but was managed for livestock grazing. Vegetation treatments after that time were done to decrease erosion and improve livestock forage.

Table 1. Vegetation treatments on the CNG by decade.

DECADE	ACRES TREATED	TREATMENT TYPES
1940 - 1949	902 acres	Plowing/seeding
1950 - 1959	2,030 acres	Brush-beating, plow/seed
1960 - 1969	12,254 acres	Brush beat, plow/seed and spray
1970 - 1979	13,211 acres	Chain/seed, plow/seed, brush beat, spray
1980 - 1989	8,245 acres	Chain/seed, spray, brush beat, prescribed burn, plow/seed
1990 - 1999	5,780 acres	Prescribed burn, wildfire
2000 - present	1,082 acres	Plow/seed

After treatment, many of the areas were seeded to non-native seed mixes. Records indicate that bulbous bluegrass, crested wheatgrass, ladak alfalfa, Whitmar wheatgrass and yellow sweet clover were species commonly seeded on the CNG, with crested wheatgrass predominating. Collins and Harper (1982) found that the *Artemesia tridentata/Agropyron spicatum* habitat types, which cover 72% of the CNG, had a fairly low diversity in the understory, with only 7 grass and forb species found in more than 5% of the plots (see Appendix B of Sagebrush Vegetative Trends paper).

Apa (1998) found that at the sage grouse nest sites in his study, native sites had an average of 21 species present, while non-native sites had an average of 13 species. Understory species richness at nest sites varied from year to year, but was highest at native sites than non-native sites. Apa found that there was no relationship between nest success for sage grouse and whether a site was native or non-native. However, his study did not follow chick survival after hatching, and this is the period when understory diversity is critical.

Field Use Relative to Treatments

Based on a comparison of lek use, nesting locations and pasture (and adjacent pastures) treatments, there doesn't appear to be any correlation between treatments and lek attendance. (see Appendix D and E).

Apa (1998) trapped female sage grouse on several leks in the GCVA, and then followed them to nest locations. Of 39 sage grouse nests that were located, 13 were on the CNG. A comparison of Apa's sage grouse nest locations on the CNG in relation to past vegetative treatments was attempted. However, because of incomplete information, lack of knowledge about where the nests actually were in relation to areas treated, and effects of treatments on adjacent fields, no clear conclusions can be made (Appendix E).

LIVESTOCK GRAZING

The CNG is managed as two allotments. The Curlew allotment has 5 herds, moved through 38 fields, and stays on the Allotment for the whole period. The Buist Allotment has 3 herds moving through 13 fields, and grazes the allotment in the spring and fall. Both allotments are deferred systems.

Through the early 1980's permittees were running at full permitted numbers. Then in the late 1980's permittees reduced their operations because of problems with brucellosis. Since that time they have been slowly rebuilding their herds and last year (2000) were up to about 97% of permitted numbers.

Disturbance/trampling during nesting

Mechanical damage, or trampling of nests is potentially a result of livestock grazing (although most nests are located under large-canopied sagebrush plants, where they are protected). Apa (1998) found that the nest initiation period for sage grouse in the GCVA ranged from 4/15 – 5/10, while the hatch date ranged from 5/5 – 6/14). K. Timothy did an analysis of the grazing systems and timing of grazing, looking at sagebrush canopy cover in the >15% category, and focusing on the period between April 16 and June 15 and using the years from 1992 to 1999. **He found that 26% of the suitable nesting habitat (based strictly on sagebrush canopy cover) was grazed before or during the nesting season and 74% of the suitable nesting habitat had not been grazed through the nesting season.**

Understory diversity

Historic evidence is that generally livestock grazing has reduced the herbaceous understory over large areas and increased sagebrush density in some areas (Connelly *et al* 2000). On the CNG, herbaceous understory may have been altered by livestock grazing on the native sites (25% of the CNG), while understory diversity on the remaining 75% has been largely modified by other forces (seeding following treatments).

Apa (1998) looked at species richness at sage grouse nest and brood sites in the GCVA. He compared plant species richness at both native and non-native sites (includes shrubs, grasses and forbs).

Species Richness	Native	Non-native
Nesting sites	21 species	13 species
Brood sites	17 species	11 species

Residual vegetation

Connelly *et al* (2000) used an average of >18 cm (7") residual vegetation as a general guideline, but recognized that height and cover requirements should be reasonable and ecologically defensible (based on height of species growing on site). Grass height measurements taken in November 1999 on ungrazed crested wheatgrass got an average height of 15" (n=209).

A range Utilization Gauge developed by the Rocky Mountain Forest and Experiment Station shows the following relationships between utilization and residual vegetation for different grass species.

Species	Average ungrazed height	Residual veg height at 50% utilization	% utilization to get 7" residual height***
Crested wheatgrass	15"	4.5"	20%
Bluebunch wheatgrass	16"	4.5"	25%
Intermediate wheatgrass*	20"	5.5"	25%
Indian ricegrass**	12"	3.0"	25%
Bulbous bluegrass	6"	1"	na

* Based on an average on accession heights from the Curlew Grassland Off-center Advanced Test Site for the Aberdeen Plant Materials Center

** Based on low-mid range of average heights listed in Hallsten *et al* 1987.

**** Based on the Range Utilization Guide

Grass and forb measurements were taken in the spring of 1999 (May), and approached but did not meet the 7" in the Guidelines. This was due to livestock grazing timing and intensity the previous season, and the dominance of Pobu in some fields. Half of those pastures sampled in the spring had residual fall (Nov) grass and forb height above 7" (information in DEIS).

Timothy and Tower (1999) took very limited grass samples to compare utilization with stubble height. For native grasses (bluebunch wheatgrass), 7" of stubble height was comparable to approximately 12% utilization. For non-native (crested wheatgrass), 7" stubble height was comparable to 46% utilization. This is a wide variation from what is shown above, using the Range Utilization Guide. The very small sample size and yearly variation in precipitation may account for this.

Information gathered in September of 2001 found that the grazed fields sampled had average residual vegetation heights of 4 to 6 inches. Ungrazed fields with crested wheatgrass understory had average heights of 6" on terraces where soils are limiting growth, and 9 to 14" on other more productive sites. One ungrazed native site was sampled and had an average height of 6".

Basically, all of these show the same general trend: it is very difficult to graze at moderate levels and meet the 7" residual height recommendation.

Riparian, seeps and springs

As sagebrush habitats dry out in the summer, sage grouse usually move to moister sites. Apa (1998) found that sites used by sage grouse broods had twice as much forb cover as independent sites. Riparian areas on the CNG have been greatly altered through past management and many do not support healthy riparian vegetation. These actions have had an effect on the ability of the streams to provide clean water and adequate aquatic habitat.

In addition, there are several small seeps and springs within the CNG, that potentially could be used for late-summer brood-rearing habitat. Most springs have been developed to provide water

for croplands or domestic livestock. These areas have generally been accessible to livestock (except Sweeten Pond) and have been impacted by trampling.

NATURAL CHANGES

DROUGHT

Drought is believed to affect sage grouse populations through increased nest predation and early brood mortality caused by decreased herbaceous forb availability, which may also affect insect abundance (Braun 1998). Over the short-term, spring and summer weather is often the primary factor in influencing sage grouse populations (IDFG 1997).

Barrett *et al* (1997) found that over the Columbia River Basin, the period from 1916-1940 was a dry period, and more recently from 1980 to present. Meteorological data indicates that most western states, including Idaho, suffered a period of extensive drought starting in 1986 and ending in 1994 (Owyhee Plan, Connelly *et al* 2000).

Meints (IDFG Biologist) summarized precipitation and heat index data from Malad for the years from 1971 to 2000. He looked at weather from May through August (nesting and brood-rearing) but could not determine a relationship between weather and juvenile to adult ratios in the fall harvest. He attributed this to the small sample sizes available. The data does show that out of the 30-year period, 10 years had above average precipitation, 5 years were at average and 15 years (or 50%) of the years had below average precipitation during this time.

Wing data collected over the GCVA since 1985 indicates that productivity varies widely from year to year (IDFG 2000). It has ranged from 575 juveniles/100 females in 1985, down to 67 juveniles/100 females in 2000. Preliminary information from chick survival studies in the Big Desert is finding >80% mortality in the first three weeks (J. Connelly, IDFG, pers. comm.).

PREDATION

Generally, it is believed that the quantity and quality of habitat used by sage grouse controls the impact of predation. Thus, predators would be expected to be most important as habitat size and herbaceous cover within sagebrush habitat decreases (Braun 1998). Although Autenreith (1981) suggested that nest predation was likely the most important predation constraint on sage grouse, predation on adult birds does occur, mostly by coyotes and red foxes. Autenrieth also suggested that ravens and ground squirrels are major nest predators.

Studies in southern Idaho looked at cause of death for 117 radio-marked sage grouse. Over the life of the studies 62% of the mortality was due to predation, 32% were hunted, 3% died as a result of vehicle collisions, <1% collided with powerlines and 2% were other (Connelly *et al* 2000). These numbers are based on eventual fate of the bird during the study period; this is not annual mortality.

Adult survival and nest success rates have varied, but do not indicate that predation was a major problem throughout the range of sage grouse (Connelly and Braun, 1997).

Connelly *et al* (2000a) reviewed studies on the effects of predation and found that predation has not been identified as a major limiting factor for sage grouse. They do recommend that for small, isolated populations and declining populations, that the effects of predation should be evaluated. However, predator management should not be implemented if the available data doesn't supports the action (nest success <25%, annual survival of adult hens <45%). One study in the GCVA (Apa 1998) found that sage grouse nest success was 44% (sample size of 41).

Apa followed hens (yearling and adult) through several years (Appendix F). There were a large number that were lost to unknown causes. However, when looking at only the adult hens, in 1989 there was a 30% survival rate (with 10%dead and 60% unknown). In 1990 there was a 33% known survival rate (44% unknown and 22% known mortality). While this is below Connelly *et al* (2000), the larger number of unknown may actually bring it up to about 45% survival.

An artificial nest study was done over the GCVA in 1999. Fifty artificial nests were laid out along roads and trails. Within 3 days, 64% of the nests were gone, and after 7 days, 84% of the nests had been lost to predators (D. Meints, IDFG Biologist). This was repeated again in 2000. Again 50 artificial nests were located, half in a control area, and half in a treatment area. Within one week, 64% of the nests in the treatment areas were lost, and 56% of the nests in the control areas were lost. Ravens were the prominent nest predators in both areas (65% of the nests), while mammalian predators (coyote, red fox and badger) took the remaining 35% of the nests.

Immediately following this, control methods were implemented to reduce nest predators, through the use of an avicide and leghold traps. Over a four-week period, they estimated removal of 37 ravens, 10 coyotes, 17 badgers, 3 red fox and 1 striped skunk. They then again placed 50 artificial nests. After one week there was a 28% nest loss in the area where predators had been reduced, while 98% of the nests were lost in the control (non-treated) area. These studies did not provide any new information but confirmed that predators will take advantage of available food sources.

Wildlife Services had proposed to conduct similar predator management in an adjacent area (Little Lost River in Butte County) in 2001. However, concerns were raised about the 2000 study (location of artificial nests along roads and trails, stakes and sand to locate nests, location of nests in areas where there was little grass cover); all of which could lead to higher than normal predation rates. Further predator control action was not taken.

WILDFIRE

The Draft LRMP includes a standard to aggressively suppress all wildfires (page 3-3).

Wildfires on adjacent BLM lands have contributed to a loss of suitable habitat in the GCVA. When summarized by decade, it appears that there have been more, and larger fires each decade (J. Kumm, BLM Biologist).

DECADE	NO. OF FIRES	AVERAGE SIZE
1970's	1	875
1980's	11	2,829
1990's	18	3,245
2000-1*	7	3,130

* Only fires larger than 100 acres are included

While not all of the acres burned have been sagebrush, most has. It generally takes 20-25 years before sagebrush returns to suitable nesting habitat; within the last 20 years there have been 9,204 acres burned. Historically, to combat cheatgrass, the burned areas have been seeded to crested wheatgrass, reducing understory diversity.

HUNTING

Seasons

Hunting is regulated by IDFG while the Forest Service is responsible for managing the habitat. While hunting is beyond the scope of this project, an overview will be presented as it is one of the factors potentially affecting sage grouse numbers.

Several comments letters from residents refer to heavy use of sage grouse in the early 1900's. By 1913, increasing numbers of hunters across their range had made it necessary to restrict harvest. Seasons closed in 1918 for several years, reopened periodically, and then closed again thru most of the 1930's (Autenrieth 1981). Following declines in the 1930's, legal hunting was stopped or very greatly reduced throughout its range. By the early 1950's, seven states had reopened hunting seasons. In 1951 Idaho had a 1-day season over 25 counties, with a bag limit of 2. Harvest estimates for this year in Idaho are 7,500 sage grouse (Edminster 1954). In 1951, it was concluded that harvest had lowered some populations below the level at which they could be maintained (Autenreith 1981).

Seasons were closed again from 1952-1955, but populations continued to decline. By the mid-1970's, there were increased efforts to survey sage grouse, in order to establish hunting seasons. During 1977 to 1995, grouse in southern Idaho were subject to relatively liberal hunting seasons during September and October. From 1990 to 1995, the hunting season was 30 days long with a limit of 3 birds per day (IDFG 1978). Because of concerns over declining populations, the season was changed in 1996 to reduce harvest by about 50%. Since 1996, seasons have been fairly conservative.

Autenrieth (1981) concluded that since sage grouse populations fluctuate widely, they could be over-harvested during a poor production year or dry fall years when birds are concentrated on a few remaining wet areas. If hunting seasons are delayed to allow population mixing in the fall and with conservative bag/possession limits (1/2, 2/4) it is unlikely that breeding population size could be affected by recreational hunting (Braun 1998).

A study of the effects of changes in hunting regulations in Colorado on sage grouse harvest and populations found that harvest was a function of total birds available in the fall. Hunters

harvested 7-11% of the fall population regardless of the season length and bag and possession limits (Braun and Beck, 1985). They concluded that this level of harvest was sustainable if nest success and chick survival were adequate.

Connelly *et al* (2000) looked at harvest rates of 504 radio-marked sage grouse in Idaho during 1978 – 1998. They found that 4% of the males were shot, 8% of the females were shot, with an overall 7% shot. They concluded that hunting losses are likely additive to winter mortality and may result in lower breeding populations. However, because of the variable and often low annual harvest rates, they may be able to withstand some level of hunting. They recommended that where populations are hunted, the harvest rates should be 10% or less of the estimated fall population.

Wing data from the Curlew area indicates a decrease in harvest from 82 birds/year from 1984-1995 to 25 birds/year from 1996-2000. In the CNG in 2000, only 25 hunters with 2 sage grouse were counted, and about 20 wings were counted in the wing barrels (IDFG 2000). Wing data indicates an average harvest of 25 birds/year, from 1996-2000. Based on estimated numbers of sage grouse (Feltis, 1999), in the GCVA (see section below), harvest is well below 10% of the population.

VIABLE POPULATIONS OF SAGE GROUSE ON THE GCVA AND CNG

In the early 1970's it was documented that about 500 sage grouse were using Huffman fields in the winter (Gunnell 1973). Gunnell (1979) estimated sage grouse populations on the Curlew to range from 400 in spring, up to 1,300 in the summer and 1,000 in winter. **He also felt that nesting and brood-rearing habitat was most limiting for sage grouse on the CNG.**

A couple of estimates of populations on the CNG have been made. In the 1985 Forest Plan, sage grouse densities and viable populations were estimated. Spillet used 25 acres of suitable habitat/bird and estimated that half of the CNG was suitable habitat. Thus, the CNG could support a year-round population of about 1,000 sage grouse. He went on to calculate the minimum viable population as 200 birds. **This number is actually an estimate of the number of sage grouse that the CNG could support at the end of the planning period, not a viable population.** The assumptions used underestimated the amount of dense sagebrush cover that would be available through the planning period.

More recent analysis by Feltis (see EIS) estimated a total breeding population of 652 grouse over the GCVA, with a young-of-the-year recruitment into the fall of between 214 and 284 chicks. For the CNG, he estimated a total population of between 537 and 581 sage grouse, with a young-of-the-year recruitment of 133 to 177 chicks. These analyses are based on data from only those leks surveyed. Not all leks are surveyed each year so that the numbers used are a minimum of the total number.

Sage grouse density was not calculated for this analysis. First, the numbers only reflect those leks that were surveyed, not the total population. Second, the habitats on the Grasslands vary widely in suitability (sagebrush canopy cover and understory diversity). Third, sage grouse freely move back and forth from adjacent private and BLM lands.

Conservation Strategy

The State of Idaho developed the Idaho Sage Grouse Management Plan in 1997. The plan was developed to provide a framework for local working groups to develop site-specific programs to improve local sage grouse populations. This Management Plan identified statewide management issues, and then more specific local management issues and strategies. The GCVA lies in Management Area 3; South Power/Oneida.

In 2000, a MOU between WAFWA, USFS, BLM, and USFWS directed each state to prepare a Conservation Plan. Development of these plans should use local working groups to resolve regional issues.

The Greater Curlew Working Group has been meeting for three years and has a core group of 12-15 members. They recognize a lack of good baseline data and have identified hunting, predation and habitat as the 3 main issues (Idaho Sate Sage Grouse meeting 4/28/01, GCVA Working Group, July 2001).

Recent conversation with T. Hemker (IDFG Upland Game Program Manager, pers. comm.) indicated that the state of Idaho had not begun to look at the Management Plan from 1997 to see how it meets the new requirements identified for each Conservation Plan, as a result of the MOU.

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APPENDIX A. Idaho Fish and Game

Lek ID	Last Count	00	99	98	97	96	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66
001	1999		0			0			0		18	24	9																							
002	2000	0	0			0			0		0	3	3																							
003	1996					0			6		13																									
004	2000	15	0	0	0	0	6		6		15	14			41	49	6	13		0	0															
005	1996					0	0		0		6	5																								
006	1998			0	4																															
007	2000	3	2	1	9	4											15	0	0	7	7					35										
008	1985																0	1	8	18	32	42	34	49	44	30	34				43	40	37			
009	?																																			
010	?																																			
011	1987														44								34	29	44	31	36									
012	1978																							8	13	31	28	39	19	44		60				
013	1999		0	0	0	0	5	3			29	31	27	35																						
014	2000	0	0	0	0	0	0	0		1	1	5	8		25	34	34																			
015	2000	13	6	8	4	5	6	0		22	23	23	18																							
016	2000	0	0	0	0	0		0			6	7	7	11																						
017	2000	0	0	2	2	0					20																									
018	1996					0					7																									
019	?																																			
020	?																																			
021	?																																			
022	2000	8	10	12	6												0	11	4	12	8	4	15	20	26	14	13	19	22		28	42	22	29	21	21
023	2000	0	6																																	
024	2000	0	5	9	15	14					27	33			0		0	7	20	8		47			18				27	26	6					
025	2000	2	3																																	
026	?																																			
027	?																																			
028	2000	4	1	3	8	9																														
029	1999		1																																	
030	2000	12	0	0	3		2	10			18	24																								
031	2000	33	40	18	6						11																									
032	1993								5																											
033	?																																			
034	1999		1																																	
035	?																																			
036	1999		2																																	
037	1999		5																																	
038	?																																			
039	2000	22	19	0	0	0																		2	10	29	12	26	13	40						
040	1997				0	0					0	6			16																					
041	2000	0	2	4	5																															
042	1978																							0	0	20										
043	2000	1	8	14	5	5						11			11		0	1	1	7	11	29		30	18	24										

Lek ID	Last Count	00	99	98	97	96	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66
044	2000	0	0	2	0	2																														
045	2000	27	8	0	7																															
046	2000	2	25	12																																
047	1999		6	3																																
048	1999		23																																	
049	2000	0	2																																	
050	1999		1																																	
051	2000	0	14																																	
052	2000	7	15																																	
053	2000	0	5	3																																
054	1999		8																																	
055	1999		25																																	
056	2000	45	34																																	
057	2000	0	3																																	
058	2000	3	15																																	
059	2000	9	8																																	
060	2000	8	13	9																																
061	2000	0	14																																	
062	1998													15								7		11	16	29	16									
063	?																																			
064	1994						0					6																								
065	2000	7	7	1	3	6	12																													
066	1982																			3																
067	1978																						34	29	44	31	34									
068	1979																0	1	8	18	32	42	34	49	40	30	36									
069	1985																																			
070	?																																			
071	2000	21																																		
072	1994							0				6																								
073	1995						0																													
074	1995						0													0	0															
075	1971																														0	22				
076	?																																			
077	1982																			0																

Where column is left blank, no monitoring was conducted on that particular lek in that particular year.

APPENDIX B.

Sage Grouse lek surveys Curlew National Grassland (information from files, district office)

LEK	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
N. 13		3							17					14	12	7			
S. Huffman				45	39	24				26					10				
W. Jacobson														12	14	25			
E. Huffman								13											
Middle Huffman										5	24		10	63					
Marble (PVT)	12	15	7				8	14		8	16		10	8	15	7			
S. Hess-Haws														2					
E. Jacobson		6					6		8	2	4	9		2	3				
Kress School																			
W. 13						5									6				
N. Canyon															4	8			
S. 13		17		24	22	25					12	15	9	8					
E. Strong (Gravel Pit)	32	5	16					9											
W. Strong				8					7				12	5		4			
N. Funk	8		14				7			7	4	7	6	2					
Nielson (PVT)	6			11			10												
N. Hess-Haws	3											4	3	3					
E. Strong			21																
W. Richards			10												5				
W. Huffman					20				12			14		15	52	15			
Fredrickson Ex.												8	15	1					
S. Funk												7	5	8	41	28			
Smith & Pett (PVT)														34		24			
E. Hunsaker															7				
Sum	**61**	**46**	**68**	**88**	**81**	**61**	**31**	**36**	**44**	**48**	**60**	**64**	**70**	**177**	**169**	**118**			
N	**5**	**5**	**5**	**4**	**3**	**4**	**4**	**3**	**4**	**5**	**5**	**7**	**8**	**14**	**11**	**8**			
Mean	**12**	**9**	**14**	**22**	**27**	**15**	**8**	**12**	**11**	**10**	**12**	**9**	**9**	**13**	**15**	**15**			

Sage Grouse lek surveys Curlew National Grassland (information from files, district office)

LEK	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
N. 13	21	42		42		27	29	21	14	14	22	20	15	11	10	8	1	8	10
S. Huffman			37	60		6		6	16	2	3	6			5				
W. Jacobson						13	16		12	11	10	2	23						
E. Huffman									36	31	44	29	34			18			
Middle Huffman									34	30	40	49		50	43	24	8	5	
Marble (PVT)										24	18	30	15	25	18	15	7	9	12
S. Hess-Haws										7	14								
E. Jacobson										35	17	26		10	4		9	6	10
Kress School										20									
W. 13											13	5							
N. Canyon											13	4					16		
S. 13														45	33		22	14	8
E. Strong (Gravel Pit)																10	28	44	50
W. Strong																			
N. Funk																			
Nielson (PVT)																			
N. Hess-Haws																			
E. Strong																			
W. Richards																			
W. Huffman																			
Fredrickson Ex.																			
S. Funk																			
Smith & Pett (PVT)																			
E. Hunsaker																			
Sum	**21**	**42**	**37**	**102**		**46**	**45**	**27**	**112**	**174**	**194**	**171**	**87**	**141**	**113**	**75**	**91**	**86**	**90**
N	**1**	**1**	**1**	**2**		**3**	**2**	**2**	**5**	**9**	**10**	**9**	**4**	**5**	**6**	**5**	**7**	**6**	**5**
Mean	**21**	**42**	**37**	**51**		**15**	**23**	**14**	**22**	**19**	**19**	**19**	**22**	**28**	**19**	**15**	**13**	**14**	**18**

APPENDIX C.

IDFG Trend Transect Routes in the Greater Curlew Valley Area

ROUTE	LEK	2001	2000	1999	1998	1997	1996
Curlew	South 13	0	0	4	0	13	14
	North 13	4	8	3	3	3	nc
	Baker	0	0	0	0	2	0
	Little Rock Sp	0	0	0	0	0	0
	Ketchum	9	10	8	8	4	2
	Huffman Springs	0	4	4			
	W. Huffman	0	0	9			
	Total	**13**	**22**	**30**	**11**	**22**	**16**
Rockland	Marble	4	1	9	14	5	5
	Exchange	3	1	1	0	1	5
	Smith/Petit	14	45	28			
	S. Funk	18	27	0	0		
	N. Funk	0	0	1	3		
	E. Jacobson	0	3	1		0	3
	W. Jacobson	15	22	19			
	W. Strong	0	0				
	N. Huffman	0	0				
	Total	**54**	**99**	**59**	**17**	**6**	**13**

* maximum number of ma les observed on lek

APPENDIX D.

LONG-TERM LEKS ON CNG WITH RECORDS SUGGESTING TEMPORARY ABANDONMENT

An attempt was made to look at periods of lek abandonment in relation to treatment dates. However, there were several problems encountered. The Forest Service lek data has lots of empty spaces; it does not indicate when a lek was surveyed and no birds were found, or if the lek was just not surveyed. In addition, FS surveys were often done only once during the survey period, rather than the 3 times necessary to meet protocol. If a lek was surveyed only once and no birds were seen, it could be a result of weather, temporary abandonment due to golden eagles or coyotes or other factors.

IDFG data was looked at, but the data is not always directly correlated with the FS data. IDFG's lek data is linked to a name and location, while the FS data is linked to a lek name. FS personnel have noted that leks move to different locations from year to year. While the lek may have moved and kept the same name (on FS table), it may be recorded as a new lek in the IDFG table.

K. Timothy has made numerous graphs showing lek use compared to treatment periods. All of these showed no correlation between lek use and vegetation treatments (K. Timothy, pers. comm.).

APPENDIX E.

FIELDS WITH SAGE GROUSE NESTS ON CNG (APA 1988-91)

FIELD AND TOTAL ACRES	TOTAL NESTS	SUCCES NESTS	UNSUCC NESTS	TREATMENTS	YEARS SINCE TREATMENT*
NW Peterson-Lonigan 1,490 acres	1	0	1	1973 chain and seed (600 acres)	17
East Richards 587 acres	1	0	1	1940's plow and seed (470 acres); 1976 burn/chain/seed (162 acres); 1986 burn (304 acres)	14/4
East Hunsaker 644 acres	1	0	1	1970 chain and seed (400 acres)	20
South Hess 517 acres	2	1	1	1970 chain and seed (500 acres); 1981 burn (200 acres); 1981 plow and seed (150 acres)	20/9
W. Vanderhoff 1,075 acres	3	1	2	1975 chain and seed (760 acres); 1975 spray (120 acres)	15
E. Grandine 517 acres	1	1	0	1962 plow and seed (450 acres); 1972 plow and seed (35 acres)	28/18
West 13 2,242 acres	3	1	2	1961 brush beat (240 acres); 1962 brush beat (400 acres)	29/28
North 13 2,468 acres	1	0	1	1961 brush beat (380 acres); 1962 plow and seed (1620 acres); 1975 seed burn (300 acres); 1982 chain/seed (200 acres)	29/28/15/9
Total	13	4	9		

* used 1990 for nesting year, but could have been from 1988 to 1991

There were 4 of Apa's nests that were in fields that had been fairly recently treated and we could find maps of the recent treatments. In East Richards the nest was located on the edge of the 1986 burn area. In the South Hess field one nest was on the edge of the 1981 burn. The second nest was on the edge of the 1981 burn and plow treatment. The nest in North 23 was NOT in or adjacent to the 1982 treatment.

APPENDIX F.

HEN FATE BASED ON APPENDIX A IN APA (1998)

YEAR	NUMBER TRAPPED FEMALES*	LAST FOUND 1988	LAST FOUND 1989	LAST FOUND 1990	LAST FOUND 1991	DEAD	HARVESTED	UNKNOWN
1988	6 YF	3	1	1	-	1	-	-
1989	9 YF	-	7	-	-	-	2 (89, 91)	-
1989	10 AF	-	6	3	-	1 (90)		-
1990	9 YF	-	-	5	1	1 (91)	-	2
1990	9 AF	-	-	3	1	1 (90)	3 (91,91,90)	1
1991	17 YF	-	-	-	15	1	1	-
1991	8 AF	-	-	-	6	1	-	1

* Y = YEARLING, A = ADULT

SUMMARY

NUMBER LAST FOUND IN FIRST YEAR	NUMBER LAST FOUND IN SECOND YEAR	NUMBER LAST FOUND IN THIRD YEAR	NUMBER LAST FOUND IN FOURTH YEAR	DEAD	HARVESTED	UNKNOWN
45	6	1	0	6	6	4

Of the 68 hens, 9% were harvested, 9% were found dead, 6% unknown and 76% couldn't be relocated and had an unknown fate. Of adults and yearlings; in 1988 there was one dead, 2 known to survive into the next year and 3 unknown (33% survival rate). In 1989 there were 13 unknown, 5 survived into the next year, and one was harvested (26% survival rate). In 1990, there were 11 unknown, 5 survived into the next year, 1 was found dead, and one was harvested (28% survival rate). 1991 was the last year, and insufficient data to look at survival. There is a large number of unknowns (50% in 1988, 68% in 1989 and 61% in 1990). Hard to draw conclusions….

When considering only the adult hens, in 1989 there was a 30% known survival rate (with 10% dead and 60% unknown); in 1990 there was a 33% known survival rate (44% unknown and 22% known mortality). Insufficient date for 1991.

APPENDIX G.

DISTANCES BETWEEN LEK AND NEST

The GIS layer that was based on Apa's study was used to determine distances from lek to nest. Of the 35 nests, the average distance was 5.5 miles, or 8.8 km. Using the 5 km guideline for non-migratory birds, in non-uniformly distributed habitats, the buffer would protect about 80% of the nests. 20% would be outside of the buffer.

APPENDIX H.

COMPARISON OF LEK SIZE OVER TIME

The IDFG 2001 lek data base was used. Three years with the highest numbers of leks surveyed were selected. I used 20 male sage grouse as the division between large and small leks.

YEAR	NO. LEKS SURVEYED	NO. OF LEKS <20 MALES	NO. OF LEKS >20 MALES	% LARGE LEKS
1976	11	1	10	91%
1990	12	7	5	42%
1999	25	23	2	8%

These numbers could be a reflection of survey intensity, maybe in 1976 only the larger leks were surveyed. However, this was during the time when lek surveys received higher priority from IDFG (J.Connelly, Research Biologist IDFG, pers. comm.) and it is expected that all leks located would have been surveyed .

These numbers could also be a reflection of changes in sagebrush canopy cover over time. As sagebrush canopy cover has increased over the CNG, so has suitable habitat.

APPENDIX I.

Sagebrush subspecies and use by sage grouse.

Nesting habitat

Thirty-three of the 38 sage grouse nests that Apa tracked were under sagebrush plants. Of these 33 nests, 52% were under basin big sagebrush (tridentata), 45% were under mountain big sagebrush (vaseyana) and 3% were under three-tip (tripartita). Nests were placed under shrubs having larger canopies and more ground and lateral cover.

Betz (6/8/2000) estimated that basin big sagebrush occupied approximately 68% of the area, mountain big sagebrush occurs over approximately 16% of the CNG and three-tip is estimated to occupy approximately 5% of the CNG. **This seems to suggest that mountain big sagebrush was used proportionally more than available and was preferred for nesting habitat.**

Brood-rearing habitat

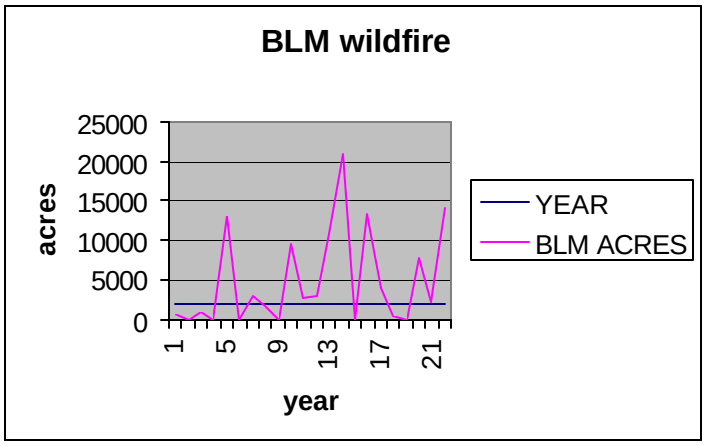
Plant species richness at sage grouse brood-rearing was higher than that at Columbian sharp-tailed grouse brood sites. This higher species richness can be expected by the sage grouse use of higher elevation, mixed shrub and mountain big sagebrush communities (Apa 1998).

Winter habitat

During winter sage grouse feed almost exclusively on leaves of sagebrush. Availability varies through and between winters depending on snow accumulations. In the 1970's the Huffman fields were documented as wintering areas. Collins and Harper (1982) mapped this area as basin big sagebrush.

APPENDIX J.

James Kumm, BLM Biologist provided information on past wildfires on BLM lands. Only fires larger than 100 acres were included before 2000.



GREATER CURLEW VALLEY AREA AND CURLEW GRASSLANDS VEGETATIVE TRENDS

PRESETTLEMENT CONDITIONS

Accounts of early explorers suggest that the vegetation of the northern Intermountain West was dominated by brush, with grasslands confined to the wet valley bottoms, moist canyons and mountain slopes (Mueggler, n.d.). Winward reviewed several historical accounts from the area, and they are summarized here. Yenson (1980) made reference to an article by Elliot (1913) who claimed the Indian name for the Snake River was "Pohagwa" meaning "sagebrush river". In 1839 a young naturalist named John Townsend recorded that the Snake River plain was covered with rugged lava and wormwood (sagebrush). Fremont (1845) called the region the "sage desert" because it was covered with *Artemesia* as far as the eye could see. All of these reports are from the Snake River Plain, to the north of the Curlew and are different sagebrush types. However, they do note dominance of sagebrush in the general area. A review of journals more specific to the area was done by Hope (1990); there was little relevant information for this area, he assumed that it was "uninspiring" and was not discussed.

It is believed that there was great spatial heterogeneity across the historic range of sagebrush. The southern part of Idaho lies in sagebrush steppe, characterized by an overstory of *Artemesia* and an understory of perennial grasses and forbs. Understory components are variable and are greatly influenced by climatic cycles. Generally years of below average (<85% of mean) precipitation occurs 20-30% of the time across historic sage grouse range. This influences the forb component, with four-fold changes between wet and dry years (all from Miller and Eddleman 2001). **They state that pre-settlement conditions ranged from dominant stands of sagebrush to grasslands.**

Barrett *et al* (1997) analyzed fire history information for the Inland Northwest and estimated that sagebrush and bunchgrass cover types had a mean fire interval of 25 years and found drought periods from 1866-1876, 1882-1891 and 1916-1940 (with accompanying higher fire frequency). Barrett (1994), when looking specifically at the Caribou NF, predicted that the mean fire interval for sagebrush types was about 19 years. He predicted that about 5% of these types would be burned each year. Winward and others suggest that for the big sagebrush types in this area, natural fire return intervals are between 20 and 40 years. **A large portion of the sagebrush ecosystem was probably composed of relatively open stands of shrubs with a strong component of long-lived perennial grasses and forbs.**

One permittee from the Curlew Valley reports that when her grandfather came to the Curlew Valley in 1870, there was "grass up to the horses belly"[1], with sagebrush next to the foothills.

[1] The dominant habitat type is a sagebrush/bluebunch wheatgrass type. Bluebunch wheatgrass grows 12"-39" depending on location and yearly precipitation (Welsh et al, 1987). Limited data on the CNG suggests that the grass height is on the lower end of this range. Field trip data (9/17-18/2001) found a range of grass heights from 6" to 16" (all species).

This sagebrush next to the foothills was aggressively dug and burned so that their land could be farmed (Skidmore, letter). Another resident reports that his great uncle, who moved into the area in the late 1880's said that the valley was dominated by grass, with sagebrush mostly restricted to rocky knolls and ridges (J. Spillett, letter). Both of these reports fall pretty closely into drought (and fire) periods reported by Barrett *et al* (1997). So at this period in time, it would be expected that these areas would have been in more open sagebrush/grassland.

CURRENT TRENDS

Gruell (n.d.) did a photographic analysis of changes in various habitat types (1872-1942 and 1968-1972) on the Bridger-Teton NF. He found that sage density was lower in earlier years than it is currently. The extent of sagebrush cover varied based on discontinuous fuels, fuel moistures, slope and topography. Generally, Gruell found that **there has been a reduction of acres burned and as a result, there has been an increase in sagebrush cover and a decrease in herbaceous understory cover.**

GREATER CURLEW VALLEY AREA

Gardner *et al* (1997) did an analysis of sagebrush habitats and canopy cover distribution over the Greater Curlew Valley Area (GCVA). There are problems with his data (misinterpretation of satellite imagery), but to date it is the only information that is available over the GCVA (see Appendix A). A more recent attempt to map sagebrush canopy cover met with some of the same problems (J. Kumm, BLM Wildlife Biologist, pers. comm.). Based on Gardners analysis, about 66% of the GCVA is considered historic sagebrush vegetation types.

Table 1. Sagebrush cover types on the Greater Curlew Valley Area (Gardner 1997)

	Curlew	BLM	Private	Sawtooth	State	BIA	Total
Total acres of all veg types	47,896	208,278	215,907	41,151	10,505	311	524,050
% ownership in GCVA	9%	40%	41%	8%	2%	<1%	100%
Acres in sagebrush types	45,272	109,426	180,691	7,683	5,294	167	348,534
% of lands in sagebrush veg types	94%	53%	84%	19%	50%	54%	**66%**

Since average acres burned would have varied based on climatic conditions, slope and aspect, it is assumed that sagebrush canopy cover would have varied greatly over time (Miller and Eddleman, 2000, Barrett *et al*, 1997, Barrett 1994 and Winward nd.). Gardner (1997) reported that from 1966 to 1996 there were 7 lightening-caused fires on the Curlew National Grassland, and 16 fires on BLM since 1961 (to 1997). All of these starts were aggressively suppressed, but it shows that there were 23 starts in that 30 year period.

The Regional PFC analysis for big sagebrush/grasslands established PFC at 10% in 0-5% canopy cover; 50% in 6-15% canopy cover; and 40% in >15% canopy cover (USFS 1996). This was modified during the Curlew PFC analysis to include a range; 10-30% in 0-5% canopy cover; 40-60% in 6-15% canopy cover; and 30-50% in >15% canopy cover. **For this analysis, it is assumed that all canopy cover classes would be roughly distributed at the midpoint of the PFC range (15/50/35).** The following table shows how sagebrush canopy cover may have been

distributed at any given time under pre-settlement conditions. Since Gardner used different canopy cover classes than were used for the rest of the analysis for this project, it was necessary to convert his categories to those used by Prevedel. This means that after converting from Prevedels canopy cover classes; based on Gardners canopy cover classes, the distribution would be 40/43/17 (see Appendix A).

Table 2. Presettlement sagebrush acres over the Greater Curlew Valley Area.

Sagebrush canopy[2]	Curlew	BLM	Private	Sawtooth	State	BIA	Total	%
Acres in <10%	18,108	43,770	72,276	3,073	2,118	67	139,414	**40%**
11-25%	19,467	47,053	77,697	3,304	2,276	72	149,870	**43%**
>25%	7,697	18,602	30,717	1,306	900	28	59,251	**17%**
Total acres in sagebrush	45,272	109,426	180,691	7,683	5,294	167	348,534	

An attempt was made to make a picture of what the GCVA must have looked like around 1910-20, at the peak of farming. Between 1924 and 1942, approximately 168,000 acres were purchased from private landowners in and adjacent to the Curlew Valley. All of the Curlew except for about 12,000 acres had been farmed.

Table 3. Historic (1910-20) sagebrush acres over the Greater Curlew Valley Area.

Sagebrush canopy	Curlew[3]	BLM	Private[4]	Sawtooth	State	BIA	Total	%
Agriculture	33,954	70,000[5]	135,518	0	0	0	239,472	69%
Acres in <10%	4,527	15,770	18,069	3,073	2,118	67	43,624	13%
11-25%	4,867	16,953	19,424	3,304	2,276	72	46,896	13%
>25%	1,924	6,702	7,679	1,306	900	28	18,539	5%
Total acres in sagebrush types	45,272	109,426	180,691	7,683	5,294	167	348,534	

To determine current distribution of sagebrush canopy cover in the GCVA, Gardners' (1997) analysis was used. While we know there are problems with some of the data used in this analysis, currently there is no better information. It will be used here only to predict general trends over the GCVA. It is also known that since 1990, 6,375 acres of BLM have burned in wildfires; it is not known how much of this was included in Gardners' calculations.

Table 4. Current (1997) sagebrush acres over the Greater Curlew Valley Area (Gardner *et al* 1997).

	Curlew	BLM[6]	Private	Sawtooth	State	BIA	Total	%[7]

[2] Canopy cover classes vary between the Gardner Report and Curlew PFC analysis. The midpoint from the range from the PFC was used, but then adjusted to match Gardners' categories.
[3] Acres not farmed were assumed to be distributed based on PFC canopy cover distribution
[4] Assumption used was that 75% of the private land was farmed, similar to CNG
[5] Estimate based on GIS query of Bankhead-Jones acres in old Malad Resource Area, BLM (J.Kumm, BLM Biologist, pers. comm.).

Grass/forb/ag	11,353	12,696	144,949	36	1,814	144	170,992	**49%**
Acres in <10%	14,608	64,256	20,334	4,134	1,546	17	104,895	**30%**
11-25%	10,611	22,544	11,129	2,372	1,286	6	47,945	**14%**
>25%	8,700	9,930	4,279	1,140	648	0	24,697	**7%**
Total acres in sagebrush types	45,022	109,426	179,202	7,819	5,253	165	348,529	

This seems to indicate that there has been a trend toward more open sagebrush canopy stands over pre-settlement conditions in the GCVA (instead of being distributed 40/43/17, it is 79/14/7). This is in part due to conversion of sagebrush stands to agricultural fields. However, this is qualified by the knowledge that at times much of the GCVA was in open canopied stands (following drought years and fire cycles) and at other periods areas were dominated by more closed canopied stands..

As a result of agriculture and CRP plantings on private land, and seedings on public lands, **understory diversity has been reduced.** In Oneida and Power counties in 1987, about 75,000 ha went into CRP (Sirotnak, Reese and Radford, 1991). Much of the CRP plantings were a mix of non-native grass (crested wheatgrass) and forb (alfalfa) mixtures that consisted of less than 5 species (Apa 1998). Records on file at the Forest Service indicate bulbous bluegrass, crested wheatgrass, ladak alfalfa, Whitmar wheatgrass and yellow sweetclover were species commonly planted on the CNG. Several thousand hectares of lower elevation BLM land had been converted to non-native rangeland through rangeland "improvement" or wildfire "rehabilitation" (Apa 1998).

Precipitation greatly influences yearly growth of grasses and forbs (Miller and Eddleman, 2001). Precipitation data gathered from Malad from May through August from 1971 to 2000 shows that 10 of the 30 years were above average, 5 were "average" and the remaining 15 years had below average precipitation.

CURLEW GRASSLANDS

The CNG comprises only 9% of the GCVA. Because it was known that there were problems with data used by Gardner, vegetation information for the Curlew Grasslands was refined further, based on Prevedels work (Process Paper A 3/27/00). This analysis figured that 95% of the Curlew is in sagebrush cover types (Gardner used 94%).

The Hudspeth trail was used from 1849-1859, as a connection from Soda Springs to City of Rocks. This trail crossed through the northern part of the Curlew. Notes from journals do not seem to say much about this section of the trail, but "wormwood" (sagebrush) is often mentioned. A couple of residents from the Curlew Valley report that when their families came to

[6] From 1998 thru 2000 acres, 24,120 acres of predominately sagebrush habitats have burned in wildfires on BLM. The assumption has been made that these acres were broken between the 11-25% and >25% canopy cover classes and Gardners numbers have been adjusted to account for this change.

[7] These numbers may vary by 1% from what is said in the DEIS, due to rounding differences and GIS data

the Curlew Valley in 1870's and 1880's, there was grass in the valley, with sagebrush next to the foothills. This would seem to imply that much of the area had burned recently, either through natural or man-caused ignitions.

By the 1860's ranchers from northern Utah grazed the Curlew and by the 1890's the south end of the Curlew was used for ranching. Heavy livestock grazing during this period may have begun to cause changes in plant species composition and structure. By the early 1900's the Curlew was homesteaded, with most of the suitable flatlands farmed. In the period between 1924 and 1942, land ownership patterns changed and in 1954 lands transferred to the Forest Service and became the Curlew National Grasslands. Since that time there have been numerous treatments across the Grasslands, largely to increase forage production.

Table 5. Treatments on the CNG

Decade	Acres of Treatment	Types of treatments
1940 - 1949	902 ac	Plow/seed
1950 - 1959	2,030 ac	Brush beat, plow/seed
1960 - 1969	12,254 ac	Brush beat. Plow/seed, spray
1970 - 1979	13,211 ac	Chain/seed, plow/seed, brush beat, spray
1980 - 1989	8,254 ac	Chain/seed, spray, brush beat, prescribed burn, plow/seed
1990 - 1999	5,780 ac	Prescribed burn wildfire
2000 - present	1,082 ac	Plow/seed

Generally, in the early 1900's, what wasn't farmed was grazed. Perry Plummer, who had worked in the area in the 1930's, returned on a tour in 1965. He noted that grasses had replaced thistle and stubble, and it appeared that old sand dunes along fences had disappeared. He also notes that the native, unplowed range appeared for the most part to be in good condition (compared to conditions in the 1930's).

The following table shows estimated sagebrush canopy cover at different periods. Presettlement estimates are based on PFC. During the period from 1910-1920, all except 12,000 acres on the CNG were farmed; these acres were put into agriculture. The remaining 12,000 acres were distributed based on PFC. The 1970's estimate is based on Gunnell 1979). The 1999 distribution is based on Prevedel.

Table 6. Sagebrush canopy cover distribution on the CNG.

	Agriculture	0-5% cc	6-15% cc	16-24% cc	>25% cc
Presettlement	0	7,140 (15%)	23,800 (50%)	11,900 (25%)	4,760 (10%)
1910-20	33,766 (75%)	1,800 (4%)	6,000 (13%)	3,000 (7%)	1,200 (3)
Early 1970's[8]	0	23,911(61%)	5,157 (13%)	5,157 (13%)	5,157 (13%)
1999	0	7,675 (17%)	10,836 (24%)	18,963 (42%)	7,676 (17%)

[8] Based on Curlew National Grassland Wildlife Development Plan (Gunnell 1979). This plan broke habitats into different categories. All of category 1 (crested wheatgrass) was put into 0-5% cc. Category 1s (crested wheatgrass and sagebrush) was distributed among all canopy cover classes. Category 1f (crested wheatgrass and >10% forbs was put into 0-5% cc based on attached "typical" photo. Category 3 (native sagebrush) was distributed among all canopy cover classes.

This suggests that there has been a trend toward more closed sagebrush canopy stands over pre-settlement conditions on the Curlew National Grasslands. This agrees with the Curlew PFC analysis. This stated that sagebrush habitats were skewed towards older age classes. However, again this is qualified by the knowledge that at times much of the Curlew was in open canopied stands and at other periods areas were dominated by more closed canopied stands.

In addition to the federal lands, there are 27,400 acres of private land within the proclaimed boundary of the CNG. In 2000, 20% was in CRP, 38% was in farmland and 42% was in pasture, based on FSA and NRCS records.

In addition, seeding following vegetation treatments and wildfire often used seed mixes with little diversity (Apa 1998). Records on file from 1950 indicate that bulbous bluegrass, crested wheatgrass, ladak alfalfa, Whitmar wheatgrass and yellow sweetclover were species commonly planted on the CNG, with crested wheatgrass predominating. **Approximately 35,500 acres (75%) of the CNG have undergone some type of seeding treatment and have decreased understory diversity.** See Appendices B and C for more information on understory diversity.

> *Note: We received several comments referring to "old growth" sagebrush. We are not managing for "old growth", but rather canopy cover.*

SUMMARY OF TRENDS

1. Over the GCVA, there has been a trend toward more open sagebrush canopy stands over pre-settlement conditions.

2. On the CNG there has been a trend toward more closed sagebrush canopy stands over pre-settlement conditions. Approximately 75% of the CNG has undergone some type of seeding treatment and has decreased understory diversity.

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Appendix A.

A comparison of Gardners' and Prevedels' sagebrush vegetation data for the CNG is shown below.

Comparison of Gardner and Prevedels' data for the Curlew National Grassland.

Gardner data		Gardner data cover	converted to classes	Prevedels canopy	Prevedels data
Veg class	**Acres**	**Veg class**	**Acres**	**Percent**	**Percent**
Gr/forb/ag	11,353 ac	0-5%	18,657 ac	41%	17%
<10%	14,608 ac	6-15%	10,841ac	24%	24%
11-25%	10,611 ac	16-24%	7,074 ac	16%	42%
>25%	8,700 ac	>25%	8,700 ac	19%	19%
Total	45,272 ac	total	45,272 ac		

This table shows that the sagebrush canopy cover information from Gardners report is fairly inaccurate. Prevedels work was field checked and refined a couple of times and better reflects actual conditions on the CNG.

Appendix B.

Habitat types and **understory diversity** on the CNG based on inventories done by Collins and Harper (1982).

Habitat type	Acres	% of CNG	Shrubs*	Forbs	Grasses
Artemesia tridentata/Agropyron spicatum	33,578	72%	3 (2)	12 (5)	4 (2)
Artemesia tridentata/stipa comata	2,517	5%	6 (5)	24 (17)	6 (5)
Artemesia vaseyana (x)/ Agropyron spicatum	7,427	16%	3 (1)	16 (10)	4 (3)
Artemesia nova/Agropyron spicatum	121	<1%	2 (1)	15 (9)	3 (3)
Artemesia vaseyana (x)/ Symphoricarpos oreophilus/Agsp	1,536	3%	8 (5)	21 (12)	8 (6)
Artemesia vaseyana (x)/ Artemesia tripartita/Agsp	1,536	3%	5 (4)	11 (9)	6 (6)

* The first number reflects the total number of species observed by habitat type. The second number (in parenthesis) is the number of species that were observed in more than 5% of the plots.

The *Artemesia tridentata/Agropyron spicatum* habitat type encompasses over 70% of the CNG and is generally found on deep, well-drained soils of the valleys. Because of its location, this type has been altered by past management**.** Presently understory diversity is very low in this type, with only 7 grass and forb species found in more than 5% of the plots.

The *Artemesia vaseyana (x)/Agropyron spicatum* habitat type is found over 16% of the CNG on moderate to steep slopes and at intermediate elevations. Understory diversity in this type is higher, with 13 species of grasses and forbs found in more than 5% of the plots.

Because of the confusion caused by use of *Artemesia vaseyana (x)* by Collins and Harper and the indeterminate status of "Bonneville" sagebrush, Betz (2000) further refined shrub communities found on the CNG. However**, the Collins and Harper data does indicate low understory diversity over much of the CNG.**

Appendix C.

Apa (1998) looked at species richness at sage grouse nest and brood sites in the GCVA. He compared species richness at both native and non-native sites (includes shrubs, grasses and forbs).

Species Richness	Native	Non-native
Nesting sites	21 species	13 species
Brood sites	17 species	11 species